APPENDIX E

ASSUMED SPENT NUCLEAR FUEL MANAGEMENT ACTIVITY DURATIONS FOR ENVIRONMENTAL IMPACT ANALYSIS

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APPENDIX E. ASSUMED SPENT NUCLEAR FUEL MANAGEMENT ACTIVITY DURATIONS FOR ENVIRONMENTAL IMPACT ANALYSIS

This appendix presents the assumed durations for each spent nuclear fuel management activity necessary to implement the alternatives described in Chapter 2. DOE used these assumed durations to analyze the environmental impacts of these activities, as described in Chapter 4. These durations are used in calculating the total impacts for the following technical disciplines: worker and public health, waste generation, and utilities and energy consumption. To estimate total impacts, DOE identified the activities (phases) necessary to implement each technology, the amount of time required for each phase of the technology, and the annual impacts estimated to occur from each phase. DOE summed the annual impacts over the entire duration of each phase of a particular technology to determine the impacts of each phase, then summed the impacts of all the phases needed to implement that technology.

In estimating these durations, DOE assumed that implementation of the spent nuclear fuel management activity began in 1998 and that the final phase would end in 2035 (for a 38-year period of analysis). The years in which each technology is likely to be available are listed in Chapter 2. DOE assumed that wet storage would continue through the date that the technology was available. The projected environmental impacts of the treatment options would (on an annual basis) be greater than continued storage; assuming that wet storage would end when treatment became available is conservative. For Conventional Processing, DOE used historic data for F- and H-Canyon operations to estimate the time needed to process the entire inventory of each type of fuel. These durations (McWhorter 1997) are expressed in terms of "dissolver-years" (i.e., the time it would take to process a given fuel group using only a single canyon dissolver). However, DOE might choose to process a given fuel group using two dissolvers concurrently. In that case, the actual duration would be half that listed in McWhorter (1997), but the annual environmental impact was estimated to be twice that of a single dissolver.

For every other technology (other than Continued Wet Storage), DOE used engineering judgment to estimate the duration of the treatment phase needed to treat the entire inventory for which the technology is applicable. DOE assumed that each new treatment technology would be capable of treating the entire spent nuclear fuel inventory in 7 years based on best engineering judgements of treatment rates. Similarly, DOE assumed that the activities necessary under the Direct Disposal/Direct Co-Disposal and Repackage and Prepare to Ship technologies (characterization, fuel conditioning, cropping, etc.) also would take 7 years for the entire inventory. DOE then assumed that the fraction of the total duration attributable to each fuel type would be equal to the fraction of that fuel type's fissile mass to the total fissile mass of spent nuclear fuel in the scope of this EIS. Use of fissile mass to calculate relative treatment durations is appropriate because it approximates the total radioactivity for each fuel group. Table E-1 lists these fissile mass fractions. Tables E-2 through E-9 list the assumed durations for each phase of the eight technologies analyzed in this EIS.

After treatment, DOE assumed that the treated and packaged fuel would be put in dry storage for the duration of the 38-year period of analysis.

Table E-1. Percent of total fissile mass attributable to each fuel type[a].

Fuel group	Percent of total fissile mass (%)
A. Uranium and thorium metal fuels	1.5
B. Material test reactor-like fuels	70
C. HEU/LEU oxides and silicides requiring resizing or special packaging	19
D. Loose uranium oxide in cans	4
E. Higher actinide targets	0.6
F. Non-aluminum-clad fuels	5

a. Source: Bickford et al. (1997).

Table E-2. Durations for Prepare for Direct Disposal/Direct Co-Disposal technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)[a]	Dry storage duration (years)
A. Uranium and thorium metal fuels	10	0.11	27.9
B. Material test reactor-like fuels	10	5.43	22.6
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	10	1.46	26.5
D. Loose uranium oxide in cans	NA	NA	NA
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.
a. Activities performed to prepare the fuel for direct disposal/direct co-disposal.

Table E-3. Durations for Repackage and Prepare to Ship technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)[a]	Dry storage duration (years)
A. Uranium and thorium metal fuels	NA	NA	NA
B. Material test reactor-like fuels	NA	NA	NA
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	NA	NA	NA
D. Loose uranium oxide in cans	NA	NA	NA
E. Higher actinide targets	10	0.04	28
F. Non-aluminum-clad fuels	10	0.35	27.65

NA = Technology is not applicable to this fuel type.
a. Activities performed to prepare the fuel for offsite shipment.

Table E-4. Durations for Melt and Dilute technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)	Dry storage duration (years)
A. Uranium and thorium metal fuels	10	0.11	27.9
B. Material test reactor-like fuels	10	5.2	22.8
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	10	1.39	26.6
D. Loose uranium oxide in cans	10	0.29	27.7
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.

Table E-5. Durations for Mechanical Dilution technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)	Dry storage duration (years)
A. Uranium and thorium metal fuels	NA	NA	NA
B. Material test reactor-like fuels	10	5.52	22.5
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	10	1.48	26.5
D. Loose uranium oxide in cans	NA	NA	NA
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.

Table E-6. Durations for Vitrification Technologies technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)	Dry storage duration (years)
A. Uranium and thorium metal fuels	10	0.11	27.9
B. Material test reactor-like fuels	10	5.2	22.8
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	10	1.39	26.6
D. Loose uranium oxide in cans	10	0.29	27.7
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.

Table E-7. Durations for Electrometallurgical Treatment technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)	Dry storage duration (years)
A. Uranium and thorium metal fuels	10	0.11	27.9
B. Material test reactor-like fuels	10	5.2	22.8
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	10	1.39	26.6
D. Loose uranium oxide in cans	10	0.29	27.7
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.

Table E-8. Durations for Conventional Processing technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)[a,b]	Dry storage duration (years)[c]
A. Uranium and thorium metal fuels	9	0.2	1
B. Material test reactor-like fuels	9	14.9	1
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	9	7.5	1
D. Loose uranium oxide in cans	9	2.2	1
E. Higher actinide targets	NA	NA	NA
F. Non-aluminum-clad fuels	NA	NA	NA

NA = Technology is not applicable to this fuel type.

a. Durations represent active processing time and do not include downtimes normally associated with processing activities.

b. Duration assumes only a single dissolver is used. If two dissolvers were used, the duration would be decreased by one-half.

c. Indicates storage of resulting low enriched uranium awaiting sale.

Table E-9. Durations for Continued Wet Storage technology.

Fuel group	Wet storage duration (years)	Treatment duration (years)	Dry storage duration (years)
A. Uranium and thorium metal fuels	38	NA	NA
B. Material test reactor-like fuels	38	NA	NA
C. HEU/LEU oxides and silicides requiring re-sizing or special packaging	38	NA	NA
D. Loose uranium oxide in cans	38	NA	NA
E. Higher actinide targets	38	NA	NA
F. Non-aluminum-clad fuels	38	NA	NA

NA = Not applicable.

References

Bickford, W. E., J. F. Krupa, D. L. McWhorter, M. E. Dupont, 1997, *Savannah River Site Spent Nuclear Fuel Environmental Impact Statement Engineering Data Book for Routine Releases*, WSRC-TR-97-0044, Westinghouse Savannah River Company, Aiken, South Carolina, April 8.

McWhorter, D. L., 1997, "SRS SNF Management EIS, SNF Processing Durations (U)," interoffice memorandum to C. B. Shedrow, Westinghouse Savannah River Company, Aiken, South Carolina, May 28.